*Ambulatory Surgery* 1994; **2**: 81–85

# Future developments in minimal access surgery in gynaecology

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Key words: Endoscopy, laparoscopy, hysteroscopy, minimal access surgery

Endoscopic procedures are being introduced into every branch of surgery. These techniques are often described as being minimally invasive, which is a misnomer and it should be understood that laparoscopy is simply a means of access by which major operations can be carried out which previously were performed through a laparotomy incision. Undoubtedly there are certain attractions to this kind of surgery. As with any new technique, this field is evolving and gynaecological surgery of the future may be very different from the gynaecological surgery of today. Predicting the future is at best a difficult exercise. Nevertheless it is the purpose of this article to examine some of the procedures which are now being performed endoscopically, evaluate the validity of these procedures, and to try to predict how endoscopic surgery will be performed in the future.

## Currently performed procedures

Until the early eighties the only gynaecologic endoscopic procedures which were performed were laparoscopic sterilization, lysis of adhesions, and destruction of small areas of endometriosis. The hysteroscope had been used to divide adhesions, septa and to resect fibroids; laser endometrial ablation had been described. Very few of these procedures, other than sterilization, were being performed routinely by general gynaecologists.

In 1994 it is easier to list the gynaecological operations which cannot be performed by endoscopic means than those which can. We have moved from the time of laparoscopic sterilization to a time where some pioneers have begun to perform radical hysterectomy by endoscopically assisted means.

## Evaluation

These procedures have been introduced with remarkable speed but little thought has been given to their true place in the surgical repertoire. It would seem reasonable that all new surgical procedures should be submitted to scientific scrutiny and an evaluation which would include assessment of the indications, a cost benefit analysis, and an understanding of the complications, not only in the hands of expert surgeons, but in the practice of those with limited experience. The efficacy of any given treatment must be established, both with respect to that option and in comparison with other treatment options. It is not possible in the limited space of this article to evaluate every possible procedure. Illustrative examples will be taken.

## Indication

Infertility and habitual abortion are common conditions. It is widely believed that uterine septa are a cause of habitual abortion. It is possible to perform myomectomy by laparoscopic means in such patients. Are these indications valid?

It would appear on initial evaluation of published data, that resection of a uterine septum would appear to improve the chances of carrying a subsequent pregnancy in a woman with habitual abortion. De Cherney et al. achieved a 53% term delivery rate following hysteroscopic resection of uterine septa in 72 patients[1]. A 73% pregnancy rate was achieved by Daly's group[2]; these were uncontrolled case series. A retrospective non-randomized study of 20 women who underwent resection of their septa and 17 who did not undergo surgery has been performed[3]. Seventy per cent of the treated and 71% of the non-treated women delivered living children. The

*Accepted:* January 1994
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0966-6532/94/020081-05

numbers in this study are too small to say that a type two error is not possible, and that indeed a difference does exist, but it has not been detected. At least there should be some consideration as to whether or not resection of the uterine septum is truly indicated.

Those myoma which can be resected laparoscopically tend to be of the subserous variety and it is possible that they do not contribute to infertility. It is worth noting that fibroids occur in 20–25% of women over the age of 30[4]. Ross et al. showed in a cohort study that 89% of women with fibroids had delivered at least one infant at term and the relative risk of spontaneous abortion was slightly, but not statistically, significantly increased[5]. Thirteen series of myomectomies were summarized by Vercellini et al.[6]. All the women were complaining of infertility, 314 women wished to become pregnant and 172 (55%) did so. Regrettably all of these studies used a patient as her own control. The outcome had no surgery been performed, clearly is unknown.

It is reasonable to infer on physiological grounds that fibroids which distort the uterine cavity or the fallopian tubes may indeed interfere with conception and implantation. Many of these are amenable to hysteroscopic resection but are the very lesions for which laparoscopic approaches are unsuitable.

*Cost*

It is widely assumed that endoscopic surgery is less expensive; Daly et al. were able to demonstrate a net savings of US$4000 per case, when resection of septa was performed hysteroscopically rather than by the abdominal route[2]. Undoubtedly such patients recover more rapidly, suffer less, and can return to the workforce more rapidly. These savings, of course, are only valid if the indication for the operation was valid in the first place. The fact remains, at present, that while many surgeons honestly believe that resection of uterine septa is to the advantage of the woman with habitual abortion, this assumption has not been proven by rigorously controlled studies.

Many variations of hysterectomy are being performed laparoscopically, the earliest was laparoscopic assisted vaginal hysterectomy (LAVH). In this procedure the upper pedicles are freed by laparoscopic means, and the uterus is removed through the vagina. It would seem that a number of these procedures which would have been performed as a routine vaginal hysterectomy in the past are now being performed with laparoscopic assistance. Summit et al. prospectively randomized 56 patients to either vaginal hysterectomy or LAVH; 27 underwent LAVH and 29 a routine vaginal hysterectomy[8]. When outcomes of interest were compared it was noted that the incidence of febrile morbidity was similar in both groups, the mean operating time for LAVH was 120.1 min which compared poorly with a 64.7 min mean time for vaginal hysterectomy. The difference in cost was dramatic. Vaginal hysterectomy cost $4891 and LAVH $7905. It may well be that in the future when the instruments required to perform these procedures become less expensive and when surgeons develop more experience and reduce their operating times, this cost margin will diminish. Certainly the ability to convert a procedure which would have been an abdominal hysterectomy into a laparoscopic assisted hysterectomy does offer the patient certain advantages, which include less pain and more rapid recovery to normal activities. The recently described subtotal laparoscopic hysterectomy may indeed prove to be superior to both LAVH and vaginal hysterectomy.

**Complications**

It is important that the magnitude of risk of any new surgical procedure is understood before such a procedure is widely adopted. Fortunately risks of modern surgery are small, but this leads to the need for evaluation of a very large number of cases before the frequency with which complications occur can be determined. Some data are available from large studies. The Royal College of Obstetricians (UK) has collected data from 147 centres which were performing hysteroscopic endometrial ablation[6]. Information was available with respect to 6850 cases, in which there were four deaths (0.24%), a rate which compares favourably with the 0.1% reported for hysterectomy[10]. Major complications occurred in 2.5% and included uterine perforation (1.25%), fluid overload (0.4%), infection (0.4%) bleeding (0.2%) and organ injury (0.1%). It would seem that from the perspective of risk, endometrial ablation is a relatively safe procedure. Such information is not available in larger series for other hysteroscopically performed operations; 17 521 cases of laparoscopy were reported from seven major centres in France[11]. There were 8343 diagnostic and 9178 operative cases. There was only one death which occurred in the operative group following vascular injury by a Trocar. In the operative group the following procedures were performed: lysis of adhesions, conservative surgery for ectopic pregnancy, salpingectomy, distal tuboplasty, ovarian cystectomy, conservative surgery, pelvic inflammatory disease, endometriosis, and uterine suspension. The 48 major complications which occurred gave a rate of 5.23‰. These are very valuable data. It is to be hoped that in the near future similar figures will be available with respect to more complicated laparoscopic surgical procedures, which will include laparoscopic hysterectomy, myomectomy, lymphadenectomy and bladder neck suspension.

*Efficacy*

It would be difficult to justify introducing a new procedure if it were to be found to be less effective than the one it was designed to replace. There are some clear examples of the value of laparoscopic surgery. Conservation of the tube in a woman with an ectopic pregnancy is best performed by the laparoscopic route, and it is difficult today, except under exceptional circumstances to justify the performance of a laparotomy for such a condition. If, however, attention is turned to endometriosis, when the patient's primary complaint is one of

pain, it is clear that a considerable number of women will find relief from their symptoms following surgical destruction of the lesions. In many cases it is simpler to perform this surgery by laparoscopic means, although from the perspective of efficacy, laparotomy and laparoscopy have never been formally compared. The association between endometriosis and infertility is still very confusing. A well designed study of treatment-dependent, and treatment-independent pregnancy rates following surgery for revised American Fertility Society ($AFS^r$) stage 1 and 2 endometriosis, does appear to suggest a beneficial effect[12]. A comparison of laparoscopy vs. laparotomy to treat these conditions showed no difference in outcome[13]. If laparoscopic surgery is to be justified for the treatment of mild to minimal endometriosis, further studies are required to demonstrate that pregnancy rate is improved. If such proves to be the case the justification for performing the operation by laparoscopic means would become those of a saving, both in money and in discomfort for the patient.

Endometrial ablation, a technique used for heavy menstrual bleeding, is becoming a very popular approach. The same study which evaluated the safety of hysteroscopy also questioned its efficacy[9]. Of the 6850 women who had been treated for dysfunctional bleeding 22% had required further surgery within one year, and almost half of these had undergone a hysterectomy, the very operation that hysteroscopic ablation was meant to replace. There are further questions with respect to endometrial ablation, which can only be answered after long term follow up studies have been performed. It is unclear whether such women would be at a greater risk of developing uterine cancer and whether or not such cancers would be occult because they would be hidden behind the scarring following the ablation. A recent study of extirpated uteri has demonstrated that following ablation, all of the specimens contained histologically normal-appearing endometrial glands underlying the coagulum[14].

### *Options*

It is reasonable to regard all surgery as a failure of medical treatment. Any therapeutic option which is equally or more effective, less invasive, and carries an equal or lower rate of complications will replace endoscopy, just as in certain instances endoscopy is replacing traditional surgery. An example of this concept is the evolving and complementary roles of laparoscopic tubal reparative surgery and the use of the new assisted reproductive technologies (ART).

If a woman is infertile because of tubal damage, she only has two viable options if she wishes to conceive. It is possible to state with a fair degree of accuracy, because of the work of several national registries, the likelihood of success following *in vitro* fertilization and embryo replacement. Armed with this information the surgeon can present to the patient a comparison of her likelihood of success using ART or following tubal reparative surgery. Scoring systems have been developed upon which it is possible to base predictions when tubal surgery is considered[15]. The distal ampullary diameter, thickness of the tubal wall, nature of the tubal mucosa, extent of any periadnexal adhesions and the type of these adhesions must all be factored into the equation. It would seem reasonable that if an individual woman had a much lesser chance of conception following tubal surgery than following ART the less invasive, though admittedly more expensive, procedure should replace the surgical option.

It is now possible to treat ectopic pregnancy by the administration of cytotoxic drugs. When 100 patients received methotrexate, 96 were considered to have been treated successfully and only five experienced side effects[16]. The tubal patency rate on the affected side was 84%. The recurrence rate of ectopic pregnancy among patients who subsequently conceived was 10%. It is now also possible to inject cytotoxic agents directly into the gestational sac using ultrasonographic guidance[17]. Whether these less invasive options will ultimately replace laparoscopic surgery for ectopic pregnancy remains to be seen.

## Predictions

In the latter half of the 20th century medical practice is no longer carried out in a vacuum, and is often submitted to intense scrutiny which is often partisan and ill informed. Patients' preferences and practice patterns can be as much influenced by public pressure as by the results of scientific study. It is a combination of influences both internal and external to the discipline which will shape the future course of endoscopic surgery in gynaecology. Within the profession the need to innovate will continue and the need to follow in the footsteps of the innovators will become increasingly apparent. It is this latter effect which is in part responsible for our willingness to embrace new approaches before they have been submitted to proper scientific scrutiny.

There is a remarkable paucity of solid information evaluating the new approaches and comparing them with the old. Some excellent starts have been made with the establishment of national registries and some small randomized studies, but a number of pressing questions need to be answered urgently and include:

1. How effective is endometrial ablation as a treatment for abnormal uterine bleeding and does it pose any long term risks of the development of uterine cancer?
2. Is it valid to resect uterine septa in women who complain of habitual abortion?
3. Should we reject vaginal hysterectomy in favour of LAVH?
4. Which fibroids should be removed, which should be removed by endoscopic means and which will still require that a formal myomectomy be performed?

Laparoscopy is beginning to find a place in oncological surgery to perform laparoscopic lymphadenectomy. Removal of the lymph nodes may be regarded as a diagnostic or therapeutic manoeuvre; Querleu et al. have reported their results from 39 patients who underwent laparoscopic lymphadenectomy[19]. The procedure took

about 90 min to complete and a mean number of nodes removed was 8.7, with a range of 3–22. These data contrast with a mean of 40 nodes removed during abdominal lymphadenectomy. A complete radical hysterectomy performed by laparoscopic methods can take up to 9 h to complete. If node sampling is not adequate and surgical times greatly prolonged, it may be that while the laparoscopic approach is technically feasible, it may not be medically justifiable.

Clearly the answers to these questions and others can only come from properly conducted observational studies of large numbers of patients, and where it is the appropriate method from randomized clinical studies of sufficient statistical power to be credible. It remains to be seen whether or not we as a profession have the collective will and the resources to begin to amass answers to these questions, and whether or not we will be prepared to modify our practices voluntarily if the answers do not confirm our earlier hypotheses.

The effect of external influences are even more difficult to predict. Advances in the instrument manufacturing sector occur with startling rapidity. Virtual reality is already being explored as a surgical training mode, it may well soon find a clinical indication. Robotic scalpels are more accurate than the human hand and are not, as is the surgeon's hand, at any risk of infection following needle puncture. Remote procedures can be carried out in space using telecommunications technologies. Is it possible that in the future a surgeon will give direct surgical commands to robotic scalpels, using telecommunications to an operating room several thousand miles distant?

Two of the major problems with laparoscopic surgery are the present methods of suturing and ligation which are cumbersome, time consuming and inefficient, and the removal of large tissue specimens. It is probable that suturing and ligating methods will be improved in the future. Although at present large tissue specimens must be removed by opening the vagina or extending the abdominal incision, morcellating devices are already being described. Steiner et al. have designed a cutting cylinder which is introduced through a 14 mm cannula and driven by an externally cited electrical microengine with which large tissue specimens can be morcellated and removed through the 14 mm cannula[19].

Consumer pressure is affecting the practice of medicine as never before. The patients are no longer passive recipients of our administration and quite reasonably expect to be informed and to play their part in defining management. The media can sway public opinion; already we are being asked to perform endometrial ablation in inappropriate circumstances because it has been extolled on a television talk show! The indications for LAVH may be more to preserve an individual surgeon's practice than because it is demonstrably better than a simple vaginal hysterectomy. We live in a world of increasing fiscal constraints. While it may be that new three dimensional imaging telescopes and the necessary backup video equipment is better than the older instruments, it will be incumbent upon us to demonstrate to those who must fund the purchase of such equipment that the measurable outcomes are demonstrably better. In many instances, the purchase of even simple endoscopic set ups may be beyond the financial abilities of some institutions. We also live in an era of intense regulatory pressure. In Canada and America no new drug can be introduced until it has been submitted to intense testing by the Health Protection Branch of the Federal Government of Canada, and the Food and Drug Administration of the United States. It is unlikely that those responsible for public policy will for much longer permit the random introduction of new surgical procedures without insisting on a rigorous evaluation process.

Finally no one can predict where advances in medical management may next occur. The fields of genetics and molecular biology are progressing with amazing rapidity. At a simpler level it was hoped that the gonadotrophin releasing agonists would provide medical treatment for fibroids; regrettably this promise was not fulfilled, but it may be that some other compound, for example one which might interfere with the actions of epidermal growth factor, may give us a weapon with which to shrink fibroids permanently, thus removing any need for surgical intervention.

## Conclusions

By examining present knowledge and trying to identify some of those forces which experience teaches may well exert effects of the direction of surgical practice, an attempt has been made to see into the future. This article has indulged in a certain amount of speculation but it will conclude with some very concrete hopes that gynaecologic endoscopic surgery will continue to evolve, at least until the surgical options have been made redundant by the introduction of effective medical therapy. The indications will be refined. Surveys and randomized studies will be performed. The influence of factors external to the practice of medicine will not influence too damaging an effect. If such an approach is developed it is probable that invalid procedures will become footnotes to medical history and that valid procedures will be refined to bring to our patients the undoubted benefits of endoscopic surgery.

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